

CLAIMS

1. An internal combustion engine comprising:
 - a crank drive rotatably disposed within an engine housing,
 - at least one double cylinder unit defined within the engine housing, the double cylinder unit comprising at least two individual cylinders,
 - a piston reciprocally movable within each individual cylinder, wherein each piston includes a piston head and the pistons are connected to the crank drive such the pistons reciprocate in the same direction within the individual cylinders, and
 - a cylinder space defined within each individual cylinder on the side of the piston head that is opposite of the crank drive, wherein a communication path is provided that interconnects the cylinder spaces during at least a portion of the reciprocal movement of the pistons.
2. An internal combustion engine according to claim 1, wherein the crank drive is arranged and constructed such that the pistons are located at their top dead center position at the same time.
3. An internal combustion engine according to claim 2, wherein the crank drive comprises a crankshaft with a crank having first and second crank pin portions, each crank pin portion having a longitudinal axis, wherein one end of a connecting rod is connected to the piston and another end of the connecting rod is connected to one of the first and second crank pin portions, and wherein the longitudinal axes of the crank pin sections are offset with respect to each other such that the connecting rods reach their extended position at the same time.
4. An internal combustion engine according to claim 2, wherein the crank drive comprises a crankshaft having a crank pin, a bridge member is mounted on the crank pin, first and second connecting rods are mounted on opposite sides of the bridge member relative to the crank pin, a guide device retains the bridge member at least in the uppermost position of the crankpin relative to the movement paths of the such that the pistons are located in their dead center position at the same time.

5. An internal combustion engine according to claim 1, wherein the individual cylinders have respective longitudinal axes that are axially and radially offset with respect to each other relative to a rotational axis of the crank drive.
6. An internal combustion engine according to claim 1, wherein the individual cylinders have longitudinal axes that are parallel to each other.
7. An internal combustion engine according to claim 1, wherein the individual cylinders have longitudinal axes that are not parallel to each other.
8. An internal combustion engine according to claim 1, further comprising a common combustion chamber that communicates with the cylinder spaces.
9. An internal combustion engine according to claim 8, wherein the common combustion chamber is defined as a recess that at least partially overlaps the cylinder spaces, and further comprising an injection valve disposed so as to open into the recess.
10. An internal combustion engine according to claim 8, further comprising three inlet valves and three outlet valves disposed such that at least one inlet valve and at least one outlet valve opens into the common combustion chamber
11. An internal combustion engine according to claim 1, further comprising at least one slot defined in a common cylinder wall that separates the individual cylinders within the double cylinder unit, the slot being arranged and constructed to permit communication between the cylinder spaces at least when the pistons are located in their bottom dead center position.
12. An internal combustion engine according to claim 11, further comprising at least two piston rings disposed around each piston, wherein the distance between the piston rings is greater than the height of the at least one slot in the longitudinal direction of the cylinder.
13. An internal combustion engine according to claim 12, wherein the piston ring that is disposed closest to the crank drive provides a gas-tight and oil-permeable seal.

14. A method for operating the internal combustion engine according to claim 11, wherein internal combustion engine further comprises:

at least one inlet valve disposed above a first piston reciprocally disposed within a first individual cylinder of the at least one double cylinder unit, the at least one inlet valve being arranged and constructed to open and close an intake channel upstream of the at least one intake valve and wherein an inlet-side cylinder space is defined above the first piston,

at least one outlet valve disposed above a second piston reciprocally disposed in a second individual cylinder of the at least one double cylinder unit, the at least one outlet valve being arranged and constructed to open and close an exhaust channel downstream of the at least one outlet valve and wherein an outlet-side cylinder space is defined above the second piston and

a charging device arranged and constructed to supply a high pressure charge to the intake channel, the method comprising:

actuating the inlet and outlet valves such that the reciprocating internal combustion engine operates at least in one load and/or speed range according to a two-stroke operation with longitudinal scavenging from the inlet-side cylinder space to the outlet-side cylinder space.

15. A method according to claim 14, wherein the valves are actuated such that the internal combustion engine operates according to a four-stroke operation during at least one of engine idling and partial engine loading and operates according to the two-stroke operation during at least one other engine load range.

16. A method according to claim 15, further comprising opening the outlet valve before the pistons expose the at least one slot during a working stroke.

17. A method according to claim 15, wherein switching between the two- and four-stroke operation is effected by at least one cam of a camshaft, which is rotating at half the crankshaft speed, being switched such that said at least one cam is inactive during four-stroke operation.

18. An apparatus for adjusting a valve stroke function of at least one valve of an internal combustion engine, comprising:

a camshaft having a first cam and a second cam,

a valve lever pivotally mounted on a mechanically fixed component and being supported on the stem of a valve, wherein the valve lever comprises an interlocking mechanism,

a first follower lever pivotally attached to the valve lever and being arranged and constructed to follow the first cam,

a second follower lever attached to the valve lever and being arranged and constructed to follow the second cam, and

the interlocking mechanism is arranged and constructed to selectively rigidly connect one of the first follower lever and the second follower lever to the valve lever, wherein when the first follower lever is interlocked with the valve lever, the valve is actuated in accordance with the first cam and, when the second follower lever is interlocked with the valve lever, the valve is actuated in accordance with the second cam.

19. An apparatus according to claim 18, wherein the valve lever is mounted on a mechanically fixed, hydraulic clearance-compensating element.

20. An apparatus according to claim 18, wherein an annular surface is defined on the camshaft between the first cam and the second cam and a contact surface of the valve lever is arranged and constructed to rest on the annular surface when the first and second follower levers are unlocked.

21. An apparatus according to claim 18, wherein the cam shaft comprises at least two second cams and two annular surfaces defined between the first cam and the respective second cams, the valve lever comprises two arms having respective contact surfaces arranged and constructed to rest on the respective annular surface, the arms project from a base portion that is arranged and constructed to rest on a stem of the valve, and the base portion supports the interlocking mechanism,

wherein the first follower lever is defined as an inner lever that is pivotally attached at a distance from the base portion between the arms of the valve lever and having a follower member arranged and constructed to follow the first cam, a recess is defined in the first follower lever and is adapted to engage an interlocking element of the interlocking mechanism and

the second follower lever is formed as a generally U-shaped outer lever, which U-shaped lever is pivotally attached at a distance from the base portion, wherein the arms and

the base portion of the valve lever are accommodated within the U-shaped lever, the arms comprise contact elements arranged and constructed to follow the second cam, a cross-piece connects the arms and has a recess adapted to engage the interlocking element of the interlocking mechanism.

22. An apparatus according to any claim 18, wherein the first follower lever, in its unlocked state, is arranged and constructed to be urged in spring contact against the first cam and the second follower lever, in its unlocked state, is arranged and constructed to be urged in spring contact against the second cam.

23. An apparatus according to claim 18, wherein one of the first and second cams is arranged and constructed to operate the internal combustion engine in a two-stroke mode and one of the first and second cams is arranged and constructed to operate the internal combustion engine in a four-stroke mode.